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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/529,751

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Susumu Kayama

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SUGHRUE MION, PLLC

2100 PENNSYLVANIA AVENUE, N.W.

SUITE 800

WASHINGTON, DC 20037

EXAMINER

BARTON, JEFFREY THOMAS

ART UNIT

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1795

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PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/529,751	Applicant(s) KAYAMA ET AL.	
	Examiner JEFFREY T. BARTON	Art Unit 1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 25 May 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-32 is/are pending in the application.
- 4a) Of the above claim(s) 1 and 27 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 2-9 is/are rejected.
- 7) ☒ Claim(s) 10-26 and 28-32 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>20050330</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Election/Restrictions

1. This application contains claims directed to more than one species of the generic invention. These species are deemed to lack unity of invention because they are not so linked as to form a single general inventive concept under PCT Rule 13.1.

The species are as follows:

- A. Oxides having a bandgap of 2.7-3.1 eV.
- B. Oxides produced by dry mixing the oxide to provide BG0-BG1 of 0.1-0.45 eV.

Applicant is required to elect a single species to which the claims shall be restricted if no generic claim is finally held to be allowable. The reply must also identify the claims readable on the elected species, including any claims subsequently added. An argument that a claim is allowable or that all claims are generic is considered non-responsive unless accompanied by an election.

Upon the allowance of a generic claim, applicant will be entitled to consideration of claims to additional species which are written in dependent form or otherwise include all the limitations of an allowed generic claim as provided by 37 CFR 1.141. If claims are added after the election, applicant must indicate which are readable upon the elected species. MPEP § 809.02(a).

2. The claims are deemed to correspond to the species listed above in the following manner:

- A. 1 and 27
- B. 2-15, 23

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The following claim(s) are generic: 16-22, 24-26, and 28-32.

3. The species listed above do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, the species lack the same or corresponding special technical features for the following reasons: As oxide or titanium oxide structures are known in the art, the special technical features of the claims must be the claimed bandgap of species A and the difference in bandgap caused by performing the method claimed in Species B, which are not shared between the groups of claims.

4. During a telephone conversation with Sheldon Landsman on 10 February 2009 a provisional election was made with traverse to prosecute the invention of Species B, claims 2-15 and 23 (Claims 2-26 and 28-32 being examined insofar as they correspond to the elected species). Affirmation of this election must be made by applicant in replying to this Office action. Claims 1 and 27 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

5. Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

Claim Objections

6. Claims 10-26 and 28-32 are objected to under 37 CFR 1.75(c) as being in improper form because a multiple dependent claim cannot depend from any other multiple dependent claim. See MPEP § 608.01(n). Accordingly, the claims have not been further treated on the merits.

Claim Rejections - 35 USC § 112

7. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

8. Claims 2-9 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

It is unclear whether the limitation in lines 3-6 of claim 2 and lines 3-6 of claim 3, "assuming that an optical band gap (hereinafter referred to as "BG") of raw material metal oxide is BG0 and the BG of metal oxide after the dry mixing is BG1" positively limits BG0 to be the optical band gap of the raw material oxide and BG1 to be the optical band gap of the product oxide. That is, the term "assuming" does not clearly require the bandgap values to be as claimed. It is suggested that the claim be amended to clearly define BG0 and BG1 as the raw material bandgap and material bandgap after dry mixing, respectively.

Similarly for claims 5-9, it is not clear that the recitation "assuming . . . time is t (minute)" in lines 3-7 of claim 5 positively limits the variables to provide the relation claimed. It is suggested that the claim be amended to clearly define the recited variables to be the respective weights, diameters, rpm, and time.

Claim Rejections - 35 USC § 102

9. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

10. Claims 2-4, 8, and 9 are rejected under 35 U.S.C. 102(b) as being anticipated by Bégin-Colin et al. [J. Solid State Chem. 149, 41-48, (2000)] Supporting evidence is provided by Fujimori. (US 6,623,129)

Regarding claims 2 and 3, Bégin-Colin et al discloses a method comprising dry-mixing a metal oxide (Anatase titanium oxide) such that the anatase phase is converted to rutile. (Experimental Details section; Figure 1) As described in Fujimori (Column 9, lines 50-55), the bandgap of anatase is 3.2 eV, while that of rutile is 3.0 eV. BG0-BG1 is therefore approximately 0.2 eV, corresponding to the range instantly claimed, and the product rutile powder reads on the structure of claim 2.

Regarding claim 4, Bégin-Colin et al use a ball mill to perform the mixing.
(Experimental Details Section)

Regarding claims 8 and 9, Bégin-Colin et al disclose in Figure 4 (Curve d) that the starting material anatase powder includes particles having diameters smaller than 20 nm (Leading edge of curve d is nonzero below line corresponding to 0.02 micrometers) and includes particles between 100 and 500 nm in diameter. Therefore, it is the Examiner's position there are populations of anatase particles in the starting material of Bégin-Colin et al having average primary particle sizes within the ranges of 10-20 nm, 20-40 nm, and 100-500 nm, thus meeting the limitations of the claims. (i.e. the group of all particles having diameters between 10 and 20 nm corresponds to instant Particle Group D, and likewise for all other claimed size ranges)

Claim Rejections - 35 USC § 103

11. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

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invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

12. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148

USPQ 459 (1966), that are applied for establishing a background for determining

obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

13. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

14. Claims 5-7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bégin-Colin et al. [J. Solid State Chem. 149, 41-48, (2000)]

Bégin-Colin et al teach a structure and method as described above in addressing claims 2-4, 8, and 9 above. In addition, Bégin-Colin et al teach wm/wp ratios of 10-40, n=710 or 1420 rpm, and t=0-150 minutes. (Experimental Details section; Figures 1, 5, and 6)

Bégin-Colin et al are silent concerning the inner diameter of the ball mill, although they disclose using media having 15 mm diameter and a mill volume of 45 cm³.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the method of Bégin-Colin et al by specifically using a mill vial having an inner diameter of about 2-4 cm, because this would accommodate the media disclosed while allowing a reasonable vial height (i.e. about 3.6-14 cm). Such selection of appropriate dimensions for the device would have been a matter of design choice to one having ordinary skill in the art, and such dimensions provide energy constants as claimed for numerous data points shown in, for example Figure 5 of Bégin-Colin et al. For example, a 3 cm diameter vial with 40:1 weight ratio of media to powder, 1420 rpm rotation, and 25 min mixing (Corresponding approximately to a data point in Figure 6 for a product of mostly rutile using alumina media) would give a k_1 of about 43,000.

In addition, in the absence of evidence of criticality of the claimed ranges, selection of appropriate milling parameters (e.g.. media/powder ratios, media diameter, time, vial size, and rotation speed) for the method generally disclosed by Bégin-Colin et al is considered to have been a matter of selection to one having ordinary skill in the art.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Dr. Jeffrey T. Barton whose telephone number is (571)272-1307. The examiner can normally be reached on M-F 9:00AM - 5:30PM.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam Nguyen can be reached on (571) 272-1342. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Jeffrey T. Barton/
Examiner
19 March 2009